

UNITED STATES PATENT APPLICATION

FOR

INTEGRATED HANDHELD DATA PROCESSING DEVICE HAVING A SLIDING
FORM FACTOR

Inventors:
HUY P. NGUYEN
LAWRENCE LAM

Prepared by:
WAGNER, MURABITO & HAO LLP
Two North Market Street
Third Floor
San Jose, California 95113

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FORM FACTOR

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FIELD OF THE INVENTION

The present claimed invention relates to the field of
handheld data processing devices. More particularly,
10 embodiments of the present claimed invention relate to an
integrated handheld device having three components with a
sliding configuration.

BACKGROUND ART

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Over the years, many electronic instruments and devices
and been sufficiently reduced in size to become portable, and
in turn, small enough to be held and operated in the hand of
the user. The advent of integrated circuits greatly increased
20 the number of devices that could achieve portability and
handheld status, as well as increasing the functionality of
such devices.

Today, handheld data processing devices include computers, video displays, audio players and recorders, laboratory instruments, telephones and other communications devices. In many cases, multiple functions may be integrated
5 into a single device such as in a telephone/audio player combination.

The data processing functions included in a handheld device may require a variety of input/output capabilities.
10 Devices with audio signal processing capabilities require a microphone for input and/or a speaker for output. Tactile transducers such as keypads and touch panel displays are useful for general alphanumeric input to a wide variety of devices. Visual displays ranging from simple indicating
15 lights to video displays capable of rendering a television broadcast may be found as the outputs on many handheld devices.

In addition to user input/output interfaces, devices may
20 also have wireless transmitters and receivers. These wireless interfaces may use radio frequency, infrared, or visible portions of the electromagnetic spectrum.

The competing interests of increasing functionality and small size in handheld devices have led to compromises in the design of the fixed form factor packages that are used for most handheld devices. For example, devices such as

5 calculators or personal digital assistants must allocate a fixed amount of available surface area to a display and a keypad.

FOOTNOTES

10 Ergonomic constraints also play a key role in the design of fixed form factor handheld devices. The degree of miniaturization that can be applied to a keypad is typically limited by the size and dexterity of an average user's fingers. Likewise, the placement of a speaker and microphone for a telephone is limited by the mouth and ear separation of

15 a typical user.

Fixed form factor handheld devices such have been supplemented by variable form factor devices having components connected by hinges. In general, hinges provide a

20 more compact form factor for storage when closed, but the device is often not functional with the hinge in a closed position (e.g., a some handheld calculators).

Conventional placements of speakers, microphones, and keyboards (keypads) yielded larger PDA form factors and resulted in undesirable telephony experiences while also not addressing issues relating to an integrated display

5 protection solution. Displays were left exposed and unprotected from debris and facial oils during phone usage. Many integrated keyboards are forced to fit within the width of a portrait-mode device, thus compromising ergonomics due to decreased key size and spacing. Further, earpiece to
10 microphone separations were solely dictated by device size, whether too small or too large.

Thus, a need exists for an adjustable form factor for handheld devices that provides functionality in both extended
15 and compact forms.

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SUMMARY OF INVENTION

Accordingly, several embodiments of the present invention include structures that provide a handheld data processing device with functionality in a variety of forms. The input and output characteristics for the device are adjustable by the user through variations of the form factor of the handheld device.

10 A handheld data processing device having three functional components assembled in a sliding configuration is disclosed. A processor module is mechanically coupled to two sliding covers. The processor module houses circuits for performing the functions of data processing and may also include a display and input/output functionality. The two sliding covers provide protection for the processor module (including display screen) and may include input/output transducers such as a keypad, speaker or microphone.

Embodiments of the handheld data processing device include a handheld computer, wireless telephone and handheld video display.

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In an embodiment of the present invention, housed as a handheld computer, the display and processing functions are integrated within a display/processor module and two keypad sliders provide a keypad for input. The keypad sliders may slide in a plane parallel to the surface of the display and may adjusted to shield or expose the display by sliding. One or both of the keypad sliders may include a transparent window that enables viewing of the display while in the closed position. In one embodiment, a "QWERTY" keypad with control and option keys is provided.

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In another embodiment of the present invention, a wireless telephone, the display and processing functions are housed in a transceiver module and the two keypad sliders provide a keypad for input. One of the two keypad sliders houses a microphone and the other houses a speaker. The two sliders are capable of sliding independently of one another and allow for adjustment of the microphone and speaker separation distance. Additionally, one or more detent mechanisms may be provided to provide for setting a repeatable and stable microphone and speaker separation distance. In this embodiment, the speaker and microphone may

be located on the side of the device that is opposite of the display.

The invention separates the traditional handheld
5 computer component package into three distinct elements that
reconfigure relative to each other through a sliding
mechanism. The articulating left/right side element may house
numerical dialer keys for telephony functionality, full
10 QWERTY keyboard, and navigation/application keys on the front
of the device and speaker and microphone on the rear of the
device. The center, fixed element may house the
display/PCB/battery, etc.

The left/right housing may slide over a majority of the
15 display module in the closed position. Advantages to this
articulation are:

decreased overall length of the product for compact
storage, one handed telephony usage, and/or keyboard input;
protection of the display from debris and sharp objects

20 during storage;

protection of the display from facial oils and chemicals
during telephony modes when device is placed against face and
ear;

provides a more ergonomically oriented keyboard design for data input/retrieval and telephone dialing that is accessible whether device is open or closed;

partially exposed display is convenient for minimal PDA
5 and/or telephony information display.

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BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention:

Figure 1 shows a handheld data processing device with a sliding form factor in an open position in accordance with an embodiment of the present claimed invention.

Figure 2 shows the handheld data processing device with a sliding form factor in a closed position in accordance with an embodiment of the present claimed invention.

Figure 3A shows a handheld data processing device with a sliding form factor in portrait display mode in accordance with an embodiment of the present claimed invention.

Figure 3B shows a handheld data processing device with a sliding form factor in portrait display mode in accordance with an embodiment of the present claimed invention.

Figure 4A shows a handheld wireless telephone with a sliding form factor in an open position in accordance with an embodiment of the present claimed invention.

- 5 Figure 4B shows a handheld wireless telephone with a sliding form factor in a closed position in accordance with an embodiment of the present claimed invention.

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Further examples of functionality and construction may be found in U.S. Patent application No. 09/932,213, "Handheld Computer Having Moveable Segments That Can Be Adjusted to Affect a Size of the Handheld Computer", filed August 17, 2001; which is incorporated herein by reference.

It should be noted that a slider or display/processor module 100 incorporated in a handheld data processing device in accordance with the present invention may have more or less functionality than the following examples. For example, a slider of a particular handheld device may be described as having a keypad, a microphone, and a window; but may just as well have only one of the named elements in accordance with the spirit of the invention. A keypad may be provided with a "QWERTY" style keyboard with control, function and option keys.

The functionality of the display/processor module 100 may include a microprocessor and memory for storage of data and instructions. The microprocessor may be a general purpose processor with a complex instruction set computer (CISC) architecture or a reduced instruction set computer (RISC)

architecture. A CISC or RISC processor is preferable for handheld computers that are focused on text and numeric processing. Alternatively, the processor may include a digital signal processor (DSP) for audio processing and analog-to-digital (A/D) or digital-to-analog (D/A) conversion capability. A DSP may serve as the front end processor for a voice recognition capability and may be combined with a RISC or CISC processor. Other processing capabilities that may be included are formatting (or coding) and modulation for wireless transmission, as well the complementary processing required for wireless reception.

The types of input that may be processed by processor/display module 100 include audio, keypad entries, touch display screen entries, and electromagnetic signals. Some of these types of input may be accepted directly by the processor (e.g., electromagnetic signals or touch display screen entries), while others may be received from a slider (e.g., audio or keypad entries).

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The processor/display module 100 may include a display area 106 such as a liquid crystal display (LCD), field emission display (FED), electronic paper, or other display

with a thin form factor. For use as a video display for stored programs material or wireless reception, a fast display such as field emission display is preferred.

5 The display 106 may also be capable of accepting input as a touch panel display. Touch panel displays are typically multilayer structures combining a transparent means of sensing the position and possibly the magnitude of a contact local to the display surface with an underlying display. The
10 overall display 106 may have a graffiti area 107 capable of accepting handwritten input. The display 106 may also have icons 108 that respond to touch.

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15 One function of sliders 101 and 102 is to protect the display/processor module 100, as shown by Figure 2. In the closed position, the two sliders completely cover the upper surface of the processor/display module 100. Each slider may have a transparent window 104, preferably made from an impact and scratch resistant polymer. In the closed position shown
20 in Figure 2, the windows 104 provide partial visibility of the display while protecting the display.

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The display driver of the device may be sensitive to the relative position of the sliders with respect to the display/processor module, and automatically adjust the area of the display used for output to match the visible area of the window region 104. For the configuration of Figure 2, the area of the display used would be limited to the area visible through the windows 104. If a touch panel display is used with software generated icons, the icons may be automatically shifted in accordance with the slider position so that they remain accessible to the user.

Figure 2 also shows a slightly modified QWERTY layout in which the standard key positions have been shifted in order to allow the layout to be separated into two halves, while occupying minimum space.

Referring again to Figure 1, slider 101 and slider 102 each include a keypad and thus are examples of a keypad slider. A membrane keypad may be preferred. Drive current and signals generated by the keypad may be coupled to the display/processor 100 by a flexible ribbon connector or sliding contacts. Alternatively, signals between the sliders

and display processor 100 may be optically coupled (e.g., a light emitting diode and detector pair).

Figure 3A shows a handheld data processing device with a display 300 that has a display orientation controller. The display orientation controller selects between two orthogonal display modes (e.g., portrait and landscape.) The portion of text 301 is displayed in portrait mode in Figure 3A, whereas Figure 3B shows a display 300 with a portion of text 303 that is displayed in landscape mode. It is appreciated that the display or portrait or landscape mode may be selected based on a user command, or, it may be automatically selected based on the orientation of the device.

The display 300 may also include a line selection driver for executing commands by using a slider to reference a line on the display. As shown in Figure 3A, a "macro command" 302 is aligned with the edge of a slider 312 and is therefore selected. A macro command is a character string that refers to an executable command or series of commands. For example, the character string may be an email address or telephone number that may be selected for sending an email or initiating a telephone call. Once selected, the macro command

may be executed by appropriate input (e.g., a keystroke or contact with a touch panel display).

Figure 4A shows a rear view of the handheld wireless device, e.g., here a telephone, with a sliding form factor in an open position in accordance with an embodiment of the present claimed invention. The telephone has three basic components: a transceiver module 400, a first slider 401 and a second slider 402. The three components are similar to the three components shown in Figure 1, and the wireless telephone may of Figure 4A may be integrated with the data processing device of Figure 1, with Figure 4A providing a rear view of the integrated device to complement the front view provided by Figure 1.

The first slider 401 includes a microphone 403 and is electrically and/or optically coupled to the transceiver module 400. The sliding interface between the slider 401 and the transceiver module 400 preferably incorporates a detent mechanism to enable repeatable and stable positioning of the slider 401 with respect to the transceiver module 400. In an integrated device, the microphone may also serve as an input device for voice recognition or recording.

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The second slider 402 includes a speaker 404 and is electrically and/or optically coupled to the transceiver module 400. The sliding interface between the slider 401 and
5 the transceiver module 400 preferably incorporates a detent mechanism to enable repeatable and stable positioning of the slider 402 with respect to the transceiver module 400. In an integrated device, the speaker may also serve as an output for stored audio program material or real-time broadcast
10 audio material.

Figure 4B shows a handheld wireless telephone with a sliding form factor in a closed position in accordance with an embodiment of the present claimed invention. For an
15 integrated device, the view shown in Figure 4B corresponds to the view shown in Figure 2, wherein the front side of the integrated device is represented by Figure 2 and the back side is represented by Figure 4B.

20 In the integration of a wireless telephone and a data processing device with a display, there is a distinct advantage in allocating the telephony functions to the side opposite of the display side. Contact between a user's skin

will tend to contaminate the a display surface, and contact between the user and the telephone is typically desirable in order to enhance the intelligibility of conversation and screen out ambient noise. In addition to the microphone 403
5 shown on slider 401, a second microphone may be included on the opposite side in an integrated device so that audio input such as speech could be input while looking at a display. In order to reduce noise, one microphone or the other may be automatically selected by the application that is currently
10 being used (e.g., telephony or voice commands).

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of
15 illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the
20 principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications are suited to the particular use contemplated. It is intended

that the scope of the invention be defined by the Claims
appended hereto and their equivalents.

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